

TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER

19391.0027

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/914956

INTERNATIONAL APPLICATION NO.

PCT/SE00/00442

INTERNATIONAL FILING DATE

6 March 2000

PRIORITY DATE CLAIMED

10 March 1999 and 9 July 1999

TITLE OF INVENTION

FIRING SIMULATOR

APPLICANT(S) FOR DO/EO/US

Hans Robertsson, Arnold Fredriksson

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. § 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as **published** (35 U.S.C. 371(c)(2)) **WO 00/53993**
  - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the Annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. Below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98, PTO-1449, 6 references.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.  
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter
16. ☒ Other items or information:

PCT/ISA/210

PCT/IPEA/409

U.S. APPLICATION NO. (If known, see 37 CFR 1.53) **09/914956**INTERNATIONAL APPLICATION NO.  
PCT/SE00/00442ATTORNEY'S DOCKET NUMBER  
19391.0027**X The following fees are submitted:****Basic National Fee (37 CFR 1.492(a)(1)-(5)):**

Search Report has been prepared by the EPO or JPO.....\$860.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) .....\$690.00

No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$760.00

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$1,000.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....\$100.00

CALCULATIONS

PTO USE ONLY

**ENTER APPROPRIATE BASIC FEE AMOUNT = \$1,000.00**Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

\$ 130.00

Claims

Number Filed

Number Extra

Rate

Total Claims

33 - 20 =

13

X \$18.00

\$ 234.00

Independent Claims

2 - 3 =

0

X \$80.00

\$

Multiple dependent claim(s)(if applicable)

+ \$270.00

\$

**TOTAL OF ABOVE CALCULATIONS = \$1,364.00**

Reduction by 1/2 for filing by small entity, if applicable.

\$

**SUBTOTAL = \$1,364.00**Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

\$

**TOTAL NATIONAL FEE = \$1,364.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +

\$

**TOTAL FEES ENCLOSED = \$1,364.00**Amount to be:  
Refunded \$

Charged \$1,364.00

- a. ☐ A check in the amount of \$\_\_\_ to cover the above fees is enclosed.
- b. ☒ Please charge my Deposit Account No. 19-5127; 19391.0027 in the amount of \$1,364.00 to cover the above fees.  
A duplicate copy of this sheet is enclosed.
- c. ☒ The Director is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-5127. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b) must be filed and granted to restore the application to pending status

SEND ALL CORRESPONDENCE TO:

Edward A. Pennington

Swidler Berlin Shereff Friedman, LLP

3000 K Street, N.W., Suite 300

Washington, DC 20007-5116

SIGNATURE

Eric J. Franklin

NAME

37,134

REGISTRATION NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER

19391.0027

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/914956

INTERNATIONAL APPLICATION NO.

PCT/SE00/00442

INTERNATIONAL FILING DATE

6 March 2000

PRIORITY DATE CLAIMED

10 March 1999 and 9 July 1999

TITLE OF INVENTION

FIRING SIMULATOR

APPLICANT(S) FOR DO/EO/US

Hans Robertsson, Arnold Fredriksson

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. § 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as published (35 U.S.C. 371(c)(2)) **WO 00/53993**
  - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the Annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. Below concern other document(s) or information included:**

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98, PTO-1449, 6 references.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.  
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter
16. ☒ Other items or information:

PCT/ISA/210  
PCT/IPEA/409

COPY

TOPT 93077 600

Atty Docket: 19391.0027

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: :  
:   
Hans Robertsson et al. :   
:   
Application No.: -- U.S. National Phase : Examiner: --  
of PCT/SE00/00442 :   
:   
Filed: herewith : Art Unit --  
  
Title: FIRING SIMULATOR

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents  
Washington, DC 20231

Sir:

Prior to examination, please amend the above-identification as follows:

In the Claims:

Please amend the claims as follows:

Clean Copy of Amended Claims

4. Simulator according to claim 1, characterised in that a reflection device (17) that reflects the alignment beam (6) so that it becomes visible in the sight (3) of the weapon is arranged with the simulator (1).

8. Simulator according to claim 6, characterised in that the prism (21) has a transparent part at least at the line of sight of the sight (3), whereby aiming can still be carried out even though the prism (21) is placed in or in front of the sight.

12. Simulator according to claim 9, characterised in that the alignment beam and the simulator beam exit in the same direction and that to the simulator (1) is attached a reflection device (10, 11) that reflects the alignment beam in the opposite direction so that the alignment beam becomes visible in the sight of the weapon.

26. Simulator according to claim 1, characterised in that the alignment mark (9) is designed with graphical symbols, such as arrows or equivalent pointers, so that it gives a graphical guidance in which direction the means of adjustment must be set when alignment is to be carried out.

#### Amended Claims

4. (Amended) Simulator according to claim 1 [or 2 or 3], characterised in that a reflection device (17) that reflects the alignment beam (6) so that it becomes visible in the sight (3) of the weapon is arranged with the simulator (1).

8. (Amended) Simulator according to claim 6 [or 7], characterised in that the prism (21) has a transparent part at least at the line of sight of the sight (3), whereby aiming can still be carried out even though the prism (21) is placed in or in front of the sight.

12. (Amended) Simulator according to claim 9 [or 10 or 11], characterised in that the alignment beam and the simulator beam exit in the same direction and that to the simulator (1) is attached a reflection device (10, 11) that reflects the alignment beam in the opposite direction so that the alignment beam becomes visible in the sight of the weapon.

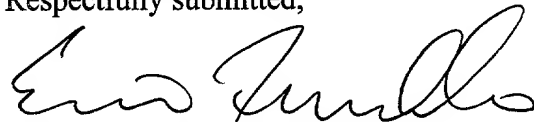
26. (Amended) Simulator according to claim 1 [or 9], characterised in that the alignment mark (9) is designed with graphical symbols, such as arrows or equivalent pointers, so that it gives a graphical guidance in which direction the means of adjustment must be set when alignment is to be carried out.

**Remarks**

Applicants have amended the claims to eliminate multiple dependencies to reduce the filing fee.

Date: September 5, 2001

Respectfully submitted,



Eric J. Franklin, Reg. No. 37,134  
Swidler Berlin Shereff Friedman  
3000 K Street, NW, Suite 300  
Washington, DC 20007  
Telephone: (202) 424-7500

FIRING SIMULATOR

## TECHNICAL AREA

- 5 The invention concerns a simulator for simulating firing. The simulator is intended for mounting onto a weapon with a sight.

## THE PRIOR ART

- 10 During simulated firing, the simulator emits a laser beam or a beam of electromagnetic radiation that has been generated by another technique than using a laser. The radiation can be detected by one or several detectors belonging to a target system mounted on the target. The emitted radiation, for example laser radiation, has different intensities in different directions of radiation, whereby these are collectively termed the laser lobe. If the radiant intensity from  
15 the laser lobe at a particular distance from the emitter and in a particular direction exceeds a detection level at any detector on the target, a simulated effect of firing with the weapon towards the target system that lies in the said direction and at the said distance is obtained.

- When a simulator is attached to a weapon, the direction of fire of the simulator must be  
20 aligned with the direction of fire of the weapon. This can be achieved by aiming the weapon with the aid of its ordinary sight towards a target that is designed to be sensitive to the simulated firing of the simulator. The simulator is fired, and one observes how the hits fall on the target in relation to the direction of firing of the weapon. If there is any deviation, the direction of firing of the simulator is adjusted by means of an adjustment device built into the  
25 simulator, until the weapon and the simulator are co-aligned.

This method is often unwieldy and takes a great deal of time, since the method is iterative. Furthermore, the target must be arranged so that it can indicate exactly where the simulator hits, in order for the adjustment to be carried out reasonably rapidly.

Arrangement of the target thus becomes complex and expensive, which means that the number of adjustment devices per trainee in a unit must be limited during firing training using weapons by means of the use of a simulator. This means that the trainees must queue in order to carry out the adjustment, and considerable time must be allocated for preparing for the training, losing valuable training time.

Patent document WO 95/30124 describes a simulator with improved properties. The firer does not need to carry out the adjustment himself/herself, since the simulator is designed for the connection of an electromechanical adjustment head that can align the firing direction of the simulator to the sight of the weapon. This method can give a considerable increase in speed of the process.

Patent document WO 95/30123 describes a device that is used according to the aforementioned patent document in order to carry out the alignment automatically. It is clear that this device also is complex and expensive, and even if the alignment procedure is more rapid, a problem arises also here with the formation of queues that tends to require a long time in preparation for the training, since the method according to the said documents is still based on observation of the results of firing the simulator in a target system.

## DESCRIPTION OF THE INVENTION

A device and a method for the simulation of firing by means of a weapon are described according to the aspect of the invention. This is carried out with a simulator, mounted on a weapon with a sight, with the simulator arranged to emit an electromagnetic simulator beam exiting along a simulator axis. Furthermore, the simulator is arranged to emit a visible alignment beam along an alignment axis, which forms a fixed and known angle with the aforementioned simulator axis.

The term "axis" is here used to describe the axis of symmetry of the directions of propagation of the respective beams.



The simulator contains a means of adjustment to collectively control both of the aforementioned axes, the simulator axis and the alignment axis, so that they maintain their fixed and known relative angular relationship during the adjustment.

- 5 The alignment beam is made visible in the weapon's sight by means of a reflection device.

The alignment beam can generate a guide mark, which, when it is viewed in the weapon's sight, indicates the error in direction between the simulator axis and the sight. This makes it possible for the firer simply to align the sight with the simulator axis with the aid of the means  
10 of adjustment.

The invention is otherwise characterised by the particular properties specified in the claims.

An advantage of a simulator according to the aspect of the invention is that it becomes  
15 possible not only in association with an exercise initially to align the simulator and the weapon after the simulator has been attached to the weapon, but also to check at intervals during the progress of the exercise that the alignment is still correct. A simulator on a light weapon is usually so placed on the weapon that it is exposed to blows and knocks, not least during exercises in forest, in connection with getting into and out of vehicles and during  
20 training in built-up areas, whereby an alignment that has been carried out may easily be disturbed. The trainees are given the opportunity by the invention to check, and if necessary adjust, the alignment of the simulator with the weapon reasonably easily.

A further major advantage is that the alignment device is small, simple and cheap, and that it  
25 can, in principle, be carried by every soldier who uses a weapon of a type that can be equipped with a simulator according to the invention.

The alignment device can be an integral part of the simulator or it can be a part that is easily attached, and which requires a minimum of space. In this way, it should be possible for a  
30 soldier to carry the alignment device without inconvenience during an exercise.

## DESCRIPTION OF THE FIGURES

Figure 1 shows a simulator on a weapon and specifies the sighting axis, the simulator axis and the alignment axis.

Figure 2 shows two images with alignment marks and the guide mark of the sight before (Figure 2a) and after (Figure 2b) adjustment.

Figure 3 illustrates an alternative appearance of the alignment mark.

Figure 4 shows the laser emitter and the alignment beam emitter.

Figure 5 shows an adjustment device for the collective adjustment of the directions of the simulator axis and the alignment axis.

Figure 6 shows how a reversing prism column returns the alignment beam.

Figure 7 shows a transparent prism column which makes it possible to see through the column from the sight.

Figure 8 shows the use of a collimator to return the alignment beam towards the sight.

Figure 9 shows a general version of the simulator with a fixed angle between the simulator axis and the alignment axis.

Figure 10 shows a means of reflection used to return the alignment beam to the sight, for a general version of the simulator.

## 30 DESCRIPTION OF THE EMBODIMENTS

In the following, a number of embodiments according to the aspect of the invention will be described, supported by the figures. A simpler version is described in the first embodiment, in

which the simulator axis and the alignment axis are made to be parallel, that is, the fixed angle between the axes in this embodiment is zero degrees.

A simulator 1 is mounted onto a weapon 2 equipped with a sight 3. A simulator beam 4 is generated in the simulator 1 along a simulator axis 5. The simulator also emits an alignment beam 6 along an alignment axis 7, which is parallel to the simulator axis 5. The weapon's sight 3 defines a sighting axis 8, and it is this sighting axis that defines the direction in which a shot will leave the weapon 2 when firing with live ammunition.

The simulator axis 5 of the simulator is to be brought to be parallel with the sighting axis 8. It would be possible to allow the alignment beam 6 to hit a target and observe in the sight 3 an alignment mark 9 made by the alignment beam. This may be associated, however, with a number of practical difficulties, such as that it may be difficult to observe the alignment beam in a situation of high ambient light. Further, a parallax error arises since the axes 5, 8 are placed at a certain distance from each other, which must be compensated for.

If one instead places the target in the focal plane of a closed optical system (a collimator 10), the ambient light will be less of a problem. Such a collimator 10 must have a diameter that allows both the alignment axis 7 and the sighting axis 8 simultaneously to pass through the optical system of the collimator 10, as is shown in Figure 8.

In cases in which the sighting axis 8 and the alignment axis 7 are separated by a considerable amount, it may be easier to use a reversing prism 11 in order to guide the alignment beam 6 to the sight 3.

A reversing prism has the property of returning incident light in exactly the opposite direction, with a parallel displacement that is determined by the design of the prism, as is shown in Figure 6.

If the prism itself 11 is placed, as a result of the placement of the simulator 1, within the sight 3 (for example between the bead and the rear sight) as shown in Figure 7, then it is an advantage if the prism 11 is provided with a semi-transparent section so that the prism does not block the sight.

If the simulator is to function in a stable manner, it is an advantage if both the simulator beam 4 and the alignment beam 6 are generated by the same optical system. Here, a laser emitter 12 is used to generate the simulator beam, and this laser emitter 12 is placed in the focal plane of an optical system. In this case, it is an advantage to place a reticle 13, which generates the alignment beam 6, in the same focal plane as the laser 12 and to connect these, that is the laser and the reticle, with a fixed mechanical connection. This arrangement using a common optical system, represented here in the form of a lens 14, and a stable mutual anchoring of the laser and the reticle in the simulator provides a simple method of ensuring that the alignment axis and the simulator axis are parallel. See Figure 4.

The collective adjustment of these two axes, the alignment axis 7 and the simulator axis 5, becomes very simple in this case. Either the optical system can be suspended in mechanically adjustable gimbals, or optical redirection elements can be used, for example a pair or rotatable optical wedges 15, in order to achieve adjustment of the direction of the axis (Figure 5).

It is appropriate to create the alignment beam 6 by allowing a lamp or light-emitting diode to illuminate the reticle 13. Alternatively, ambient light can be guided onto the reticle.

The alignment device is attached during the alignment procedure, so that the prism device on the simulator and any illumination of the reticle 13 that is required are activated. This means that a stable image of the reticle 13 – the alignment mark 9 – is obtained in the sight 3. See Figure 2a, in which the sighting mark 16 of the sight 3 is also shown.

A means of adjustment (not shown) is linked to the adjustment device of the simulator with which the alignment axis (and thus also the simulator axis) can be influenced. Adjustment screws are usually used. The alignment mark 9 can now be moved by these adjustment screws within the sight 3 so that co-alignment of the alignment axis 7 (and thus the simulator axis 5) and the sighting axis 8 can be achieved. (Figure 2b).

In some cases only a part of the alignment reticle will be visible in the sight 3. The visible part must then indicate how the adjustment screws are to be turned in order to achieve co-alignment. Several different embodiments of the alignment reticle 13 are possible. One further

example is shown in Figure 3. The alignment mark 9 can include arrows or other equivalent graphical symbols that clearly indicate the directions for turning the means of adjustment. In cases where it is only of interest to observe the alignment mark 9 in association with the adjustment, it can be an advantage to be able to remove from the simulator 1 those parts that are only required during the alignment. If a returning prism is used, it is natural to be able to remove this easily and store it separately. An alternative is that it may be folded into the simulator so that it is better protected.

In those cases in which the prism is removed, it is an advantage if the parts of the mechanical adjustment device can be removed that would otherwise be liable to damage when the simulator is used in the field.

It is then appropriate that the removable units are built together to form a module. Electronic circuits associated with the alignment method can then be included in this module, for example, the circuits to activate illumination of the reticle and the circuits to define such simulator properties for the weapon as laser power, to define the range of the weapon, and code parameters, in those cases in which the simulator provides codes specific for the weapon during the simulation.

In those cases in which it is desired to check the alignment during operational use, it can be appropriate to have a semi-transparent prism column, and that only a part of the common light emitted from the optical system is directed to the prism column. In this case, the alignment mark 9 can be allowed to light up, for example, on each shot fired. It thus becomes visible in the sight 3 and can be used as an indication that the simulator simulates and that the alignment is correct.

It is also possible to use the actual simulator beam 4 as the alignment beam 6 by allowing the normally invisible simulator beam 4 to hit a wavelength converter which converts the simulator beam 4 to visible light. It can be particularly appropriate to use a wavelength converter as a projection screen in the collimator in cases in which a collimator is used to return the simulator beam, the wavelength converter then generates a visible mark that specifies the direction in which the simulator beam exits from the simulator.

A more general version of the simulator 1 according to the aspect of the invention is shown in Figure 9. The difference that characterises this version of the simulator in relationship to the one that has just been described is that the alignment axis 7 is allowed to deviate by a fixed angle  $\alpha$  from the simulator axis 5. If the said fixed angle  $\alpha$  is known, the reflection device 17 can be designed so that the alignment axis is parallel to the simulator axis 5 after passage through the reflection device, and can thus be used to align the simulator to the sight of the weapon. The fixed angle between the simulator axis and the alignment axis is maintained during the adjustment. Such an arrangement is shown in Figure 9, in which the simulator 1 is attached to a weapon 2. The simulator emits a simulator beam 4 in the form of a laser lobe, in the same way as described above, the axis of symmetry of which is used as the simulator axis 5, and a visible alignment beam 6 along the alignment axis 7, where the simulator axis and the alignment axis form a known angle  $\alpha$  to each other. A reflection device 17 is introduced during adjustment into the pathway of the simulator beam and the alignment beam in order to make the alignment beam visible in the sight. A general example of such a reflection device 17 includes three mirrors 18, 19 and 20, and is shown in Figure 9. The first mirror 18 and the second mirror 19 function as a roof prism and redirect at the same time the alignment beam 6 by an angle of essentially  $90^\circ$  in the vertical direction (in this example). A third mirror 20 is arranged at such a distance from the first two mirrors 18, 19 and at such a chosen angle to the first two mirrors 18, 19 that the alignment beam 6 is returned to the sight 3 with its alignment axis 7 parallel to the simulator axis 5 after compensation for the known angle  $\alpha$ . The alignment mark 9 can thus be observed in the sight, after which the alignment can be adjusted. Three mirrors with an angle exactly or close to  $90^\circ$  between them provide a function that does not critically depend on their mounting relative to the simulator. This is why the roof prism function is used. The mirrors can consist of polished and mirror-coated (or total reflecting) external surfaces of a glass prism, giving a stable construction.

An alternative method for compensating for the angle  $\alpha$  is to use a reversing prism 21, which has mutual angles of exactly  $90^\circ$  between the three mirror surfaces, and in which the incident and reflected beams are parallel, together with an optical wedge 24, as shown in Figure 10.

The function of the optical wedge is to compensate for the angle  $\alpha$ .

## CLAIMS

1. Simulator (1) constructed for the simulation of firing mounted onto a weapon (2) with a sight (3), in which the simulator (1) is equipped with a first device (12) that emits an electromagnetic simulator beam exiting along a simulator axis (5), **characterised** in that
- 5 - the simulator (1) is also equipped with a second device (13) that generates an alignment beam along an alignment axis (7)
- the angle between the simulator axis (5) and the alignment axis (7) is fixed and known, and that
- 10 - the simulator (1) includes a means of adjustment that collectively guides the alignment axis (7) and the simulator axis (5) during the alignment of the simulator axis (5) with the sight (3) so that the said axes during the alignment maintain the fixed relative angular relationship.
- 15 2. Simulator according to claim 1, **characterised** in that the first device (12) consists of a laser emitter.
3. Simulator according to claim 1, **characterised** in that the simulator (1) includes a wavelength converter that converts the alignment beam to visible light.
- 20 4. Simulator according to claim 1 or 2 or 3, **characterised** in that a reflection device (17) that reflects the alignment beam (6) so that it becomes visible in the sight (3) of the weapon is arranged with the simulator (1).
- 25 5. Simulator according to claim 4, **characterised** in that the reflection device (17) consists of a first mirror (18) and a second mirror (19) that function as a roof prism and deflect the alignment beam (6) by 90° and a third mirror (20) placed at such a distance from the first and second mirrors and at such an angle relative to them that the alignment beam (6) is reflected into the sight (3) with the alignment axis (7) parallel to the simulator axis (5).
- 30

- 5
6. Simulator according to claim 5, **characterised** in that the reflection device (17) consists of a prism (21) with first reflecting surfaces (22) and a second reflecting surface (23) arranged at such an angle relative to each other that the alignment beam (6) is deflected back into the sight (3) with the alignment axis (7) parallel to the simulator axis (5).
- 10
7. Simulator according to claim 4, **characterised** in that the reflection device consists of a reversing prism (21) dimensioned so that the alignment beam (6) is deflected back into the sight (3), and where an optical wedge (24) is arranged in the pathway of the alignment beam (6) by the reversing prism, whereby the optical wedge (24) refracts the alignment beam (6) so that the alignment axis (7) at the sight (3) becomes parallel with the simulator axis (5).
- 15
8. Simulator according to claim 6 or 7, **characterised** in that the prism (21) has a transparent part at least at the line of sight of the sight (3), whereby aiming can still be carried out even though the prism (21) is placed in or in front of the sight.
- 20
9. Simulator according to claim 1, **characterised** in that the fixed angle between the simulator axis (5) and the alignment axis (7) is zero degrees, that is, the said axes are mutually parallel.
- 25
10. Simulator according to claim 9, **characterised** in that the first device (12) consists of a laser emitter.
- 30
11. Simulator according to claim 9, **characterised** in that the simulator (1) includes a wavelength converter that converts the alignment beam to visible light.
12. Simulator according to claim 9 or 10 or 11, **characterised** in that the alignment beam and the simulator beam exit in the same direction and that to the simulator (1) is attached a reflection device (10, 11) that reflects the alignment beam in the opposite direction so that the alignment beam becomes visible in the sight of the weapon.
13. Simulator according to claim 12, **characterised** in that the reflection device consists of a projection screen.



14. Simulator according to claim 12, **characterised** in that the reflection device consists of a collimator (10).

5 15. Simulator according to claim 12, **characterised** in that the reflection device consists of a reversing prism column (11).

10 16. Simulator according to claim 15, **characterised** in that the reversing prism column (11) has a transparent part at least in the line of sight of the sight (3), whereby aiming can be carried out despite the fact that the reversing prism column (11) is placed in or in front of the sight.

15 17. Simulator according to claim 1, **characterised** in that the alignment beam (6) is generated by an illuminated reticle (13) in the focal plane of an optical system.

20 18. Simulator according to claim 17, **characterised** in that the reticle (13) is illuminated by means of an artificial light source.

25 19. Simulator according to claim 17, **characterised** in that the reticle (13) is illuminated with the aid of a means of guiding light that guides ambient light to the reticle.

30 20. Simulator according to claim 1, **characterised** in that the alignment beam (6) and the simulator beam (4) have common focussing optical elements for their focussing.

25 21. Simulator according to claim 20, **characterised** in that the alignment beam (6) and the simulator beam (4) are generated by components that are mechanically attached to each other in the focal plane of the common optical system.

30 22. Simulator according to claim 1, **characterised** in that those parts of the simulator (1) that are only required during adjustment are arranged in a demountable module.

23. Simulator according to claim 22, **characterised** in that the demountable module includes at least one of the devices related to the alignment beam (6).

24. Simulator according to claim 23, **characterised** in that the demountable module includes parts of the means of adjustment.

5 25. Simulator according to claim 23, **characterised** in that the demountable module includes a means for storing data that has been supplied to the simulator (1) in association with an alignment.

10 26. Simulator according to claim 1 or 9, **characterised** in that the alignment mark (9) is designed with graphical symbols, such as arrows or equivalent pointers, so that it gives a graphical guidance in which direction the means of adjustment must be set when alignment is to be carried out.

15 27. Method of alignment of a simulator (1) mounted onto a weapon (2) with sight (3) **characterised** in that the method includes the following steps:  
- the simulator emits an electromagnetic simulator beam (4) that exits along a simulator axis (5),  
- the simulator generates an alignment beam (6) along an alignment axis (7), which forms a fixed and known angle relative to the said simulator axis (5),  
20 - the alignment axis (7) and the simulator axis (5) by means of a means of adjustment are collectively guided so that the said axes during an alignment or during an adjustment of the alignment maintain the said fixed relative angular relationship to each other and that  
- the alignment axis (7) is adjusted to be parallel with the sighting axis (8) of the sight  
25 (3).

28. Method according to claim 27, **characterised** in that a wavelength converter converts the alignment beam to visible light.

30 29. Method according to claim 27, **characterised** in that the simulator beam is caused to be reflected from a wavelength converter material, whereby visible light is emitted and used as the alignment beam (6).

30. Method according to claim 27, **characterised** in that the alignment beam produces an alignment mark (9) that becomes visible to the firer when the sight (3) of the weapon (2) is used.

5 31. Method according to claim 29, **characterised** in that the alignment mark (9) is made visible only in association with the conduct of an alignment or a check of the alignment.

10 32. Method according to claim 29, **characterised** in that the alignment mark (9) is made visible in association with every shot fired by the weapon so that the firer obtains confirmation that a simulation shot has been fired and that the alignment is still correct.

33. Method according to claim 27, **characterised** in that the alignment beam (6) and the simulator beam (4) are focussed by means of the same optical components.

1/4

Fig. 1

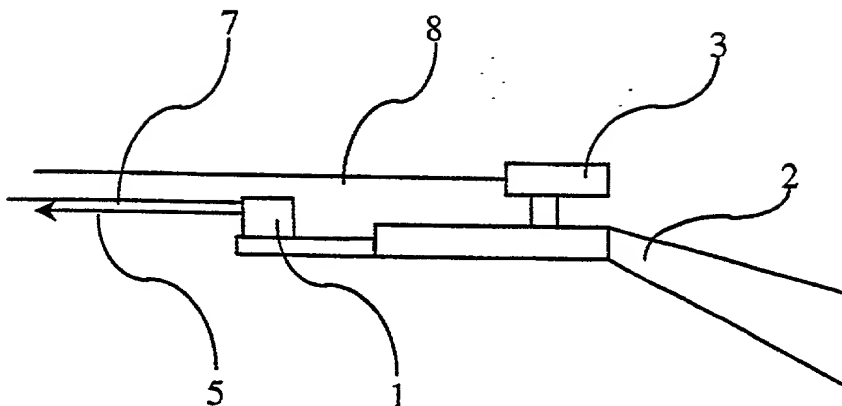


Fig. 2a

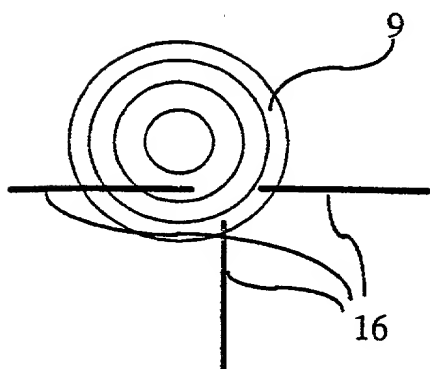


Fig. 2b

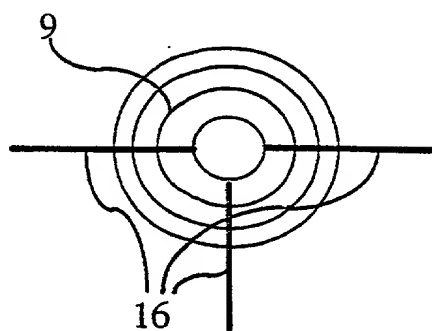
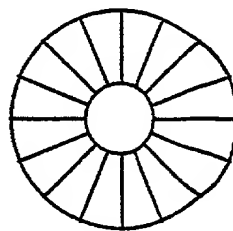


Fig. 3



2/4

Fig. 4

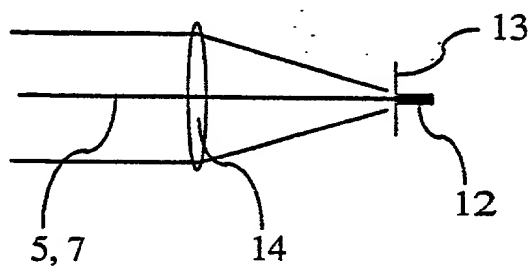
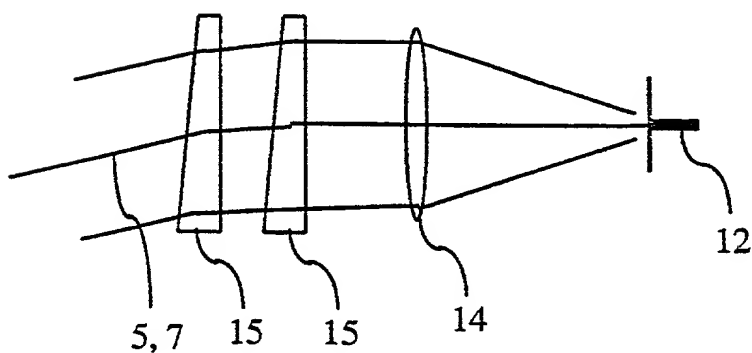


Fig. 5



3/4

Fig. 6

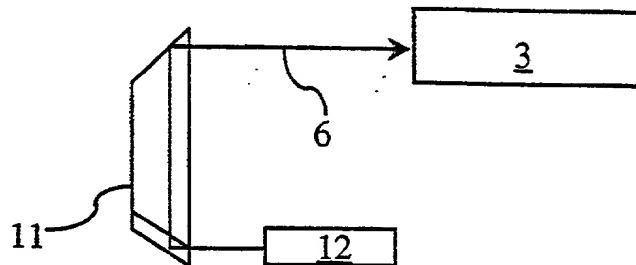


Fig. 7

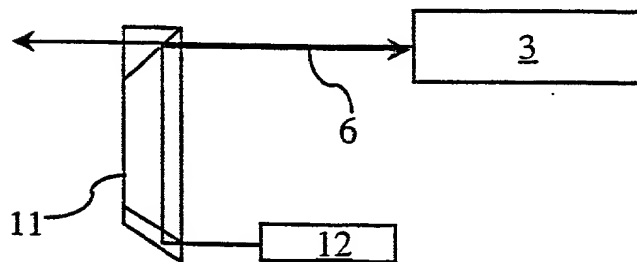
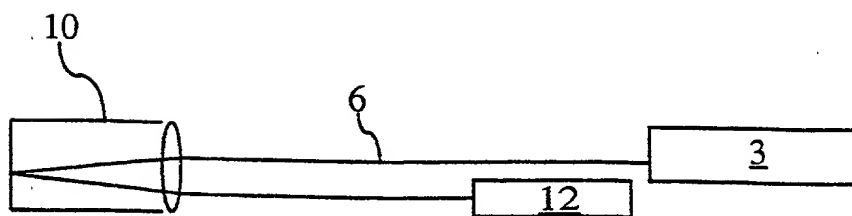


Fig. 8



4/4

Fig. 9

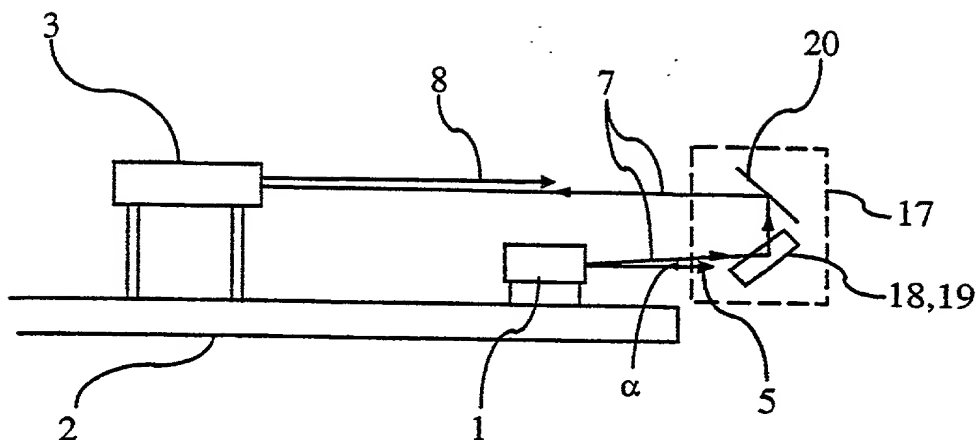
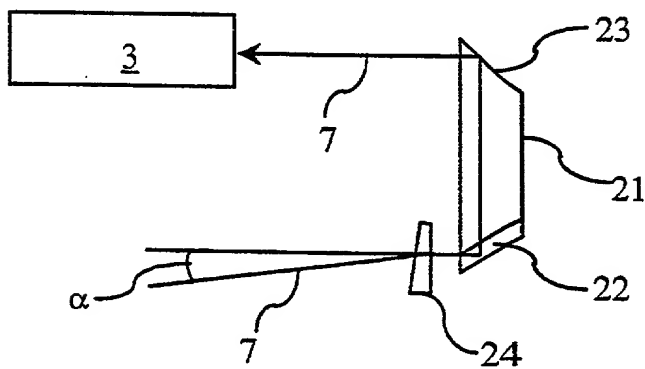


Fig. 10



218  
909

Docket No. 19391.0027

COMBINED DECLARATION AND POWER OF ATTORNEY FOR  
ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL,  
DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

FIRING SIMULATOR

the specification of which

- a. ☐ is attached hereto
- b. ☐ was filed on \_\_\_\_\_ as application Serial No. \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

PCT FILED APPLICATION ENTERING NATIONAL STAGE

- c. ☒ was described and claimed in International Application No. PCT/SE00/00442 filed on 6 March 2000 and as amended on \_\_\_\_\_. (if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56.

I hereby specify the following as the correspondence address to which all communications about this application are to be directed:

SEND CORRESPONDENCE TO:

Edward A. Pennington  
SWIDLER BERLIN SHEREFF FRIEDMAN, LLP  
3000 K Street, N.W., Suite 300  
Washington, D.C. 20007-5166

DIRECT TELEPHONE CALLS TO: Eric J. Franklin, 202-424-7500

- ☒ I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or under § 365(b) of any foreign application(s) for patent or inventor's certificate or under § 365(a) of any PCT international application(s) designating at least one country other than the U.S. listed below and also have identified below such foreign application(s) for patent or inventor's certificate or such PCT international application(s) filed by me on the same subject matter having a filing date within twelve (12) months before that of the application on which priority is claimed:



- ☒ The attached 35 U.S.C. § 119 claim for priority for the application(s) listed below forms a part of this declaration.

Country/PCT	Application Number	Date of filing (day, month, yr)	Date of issue (day, month, yr)	Priority Claimed
Sweden	9900843-5	10 March 1999		<input checked="" type="checkbox"/> Y <input type="checkbox"/> N
Sweden	9902670-0	9 July 1999		<input checked="" type="checkbox"/> Y <input type="checkbox"/> N
				<input type="checkbox"/> Y <input type="checkbox"/> N

- ☐ I hereby claim the benefit under 35 U.S.C. § 119(e) of any U.S. provisional application(s) listed below.

Provisional Application No.

Date of filing (day, month, yr)

ADDITIONAL STATEMENTS FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART  
OR PCT INTERNATIONAL APPLICATION(S DESIGNATING THE U.S.)

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s) or under § 365(c) of any PCT international application(s) designating the U.S. listed below.

US/PCT Application Serial No.	Filing Date,	Status (patented, pending, abandoned)/ U.S. application no. assigned (For PCT)
US/PCT Application Serial No.	Filing Date,	Status (patented, pending, abandoned)/ U.S. application no. assigned (For PCT)

- ☐ In this continuation-in-part application, insofar as the subject matter of any of the claims of this application is not disclosed in the above listed prior United States or PCT international application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or Imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

9 I hereby appoint the following attorneys and/or agents with full power of substitution and revocation, to prosecute this application, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith: Edward A. Pennington (Reg. No. 32,588), John P. Moran (Reg. No. 30,906), Eric J. Franklin (Reg. No. 37,134), Michael A. Schwartz (Reg. No. 40,161), Robert C. Bertin (Reg. No. 41,488), Alicia A. Meros (Reg. No. 44,937), Chadwick A. Jackson (Reg. No. 46,495), Edward J. Naidich (Reg. No. 43,826), and Sean O'Hanlon (Reg. No. 47,252) of Swidler Berlin Shereff Friedman having an address of 3000 K Street, N.W., Suite 300, Washington, D.C. 20007-5116.

Full name of sole or first inventor Hans Robertsson

Inventor's signature Hans Robertsson

Date: 15 September 2001

Residence: Astronomgatan 10, S-554 48 Jönköping, Sweden SEX

Citizenship: Sweden

Post Office Address: Astronomgatan 10, S-554 48 Jönköping, Sweden

Full name of second inventor Arnold Fredriksson

Inventor's signature Arnold Fredriksson

Date: 27 August 2001

Residence: Vallmostigen 5, S-561 39 Huskvarna, Sweden SEX

Citizenship: Sweden

Post Office Address: Vallmostigen 5, S-561 39 Huskvarna, Sweden



ATTACHED IS ADDED PAGE TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR SIGNATURE BY THIRD AND SUBSEQUENT INVENTORS FORM.